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ABSTRACT

The measurability of sensorimotor development in 60 severely retarded, institutionalized adults was studied, using the Piagetian concept of object permanence in a delayed recall paradigm that involved special apparatus. Results suggested, among other things, that severely retarded, institutionalized adults learn most efficiently when trained with no interpolated delays. Modest correlations were found between performance on the object permanence tasks and on the Bayley Motor Scale, and somewhat stronger correlations were found between object permanence task performance and Bayley Mental Scale scores. The Vineland Social Maturity Scale scores tended to correlate in an intermediate range between the two Bayley scale scores. The Ss were shown to be capable of representational schema and of retaining memory of an image in relation to external cues over brief time periods of a 30 second delay. Their level of development of representational schemata functioning appeared to be similar to that of 36 month old normal children. (Author/DLS)

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PIAGETIAN OBJECT PERMANENCE IN SEVERELY MENTALLY RETARDED ADULTS

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The cognitive structures of infancy have been described by Piaget (1963) as the sensorimotor period (0 - 2 years), which is heirarchically organized into six substages. The development of object permanence evolved gradually during the substages as the infant realizes the object exists without acting upon it. Piaget has demonstrated that the action schema of the sensorimotor period is tied to the retention of a stimulus through an internalized image of that stimulus which has become associated with external cues. The schema is described as action which recognizes the permanence of objects. or example, Piaget found that the infant vigorously searched for an object out of sight at 9 months, continued to follow an object through a series of visible displacements from 12-18 months, and later inferred sequential displacements with the object hidden from view during 18 to 24 months (Uzgiris and Hunt, 1975; Phillips, 1969).

Inhelder (1968) applied Piaget's formulations of the sensorimotor period to the cogritive development of the mentally deficient and confirmed the sequence of sensorimotor development which Piaget observed in normal infants as similarly occurring in the severely and profoundly retarded. Woodward (1959) classified permanence of objects into six sub-stages, which corresponded with primary, secondary, derived secondary, and tertiary circular reactions of the sensorimotor period in 87% of the 147 severely retarded subjects tested.

Uzgiris and Hunt (1975) have developed as assessment for infancy based upon Piaget's definition of the sensorimotor period. Six ordinal scales were used to chart developmental progress, including visual pursuit and permanence of objects. The Uzgiris and Hunt Scales we e examined with 63 severely

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and profoundly retarded children by Kahn (1976), and the findings were interpreted as indicating that these scales could be used reliably and validly with this population for measurement of object permanence.

While the Uzgiris and Hunt Scales (1975) have been recognized and employed for assessing permanence of objects, a different approach has been suggested by the investigations of Clark and Brockman (1966) who used a delayed-recall technique to examine the retention of a correct stimulus under delay and no-delay conditions with normal subjects. They found that 18- to 24-month old subjects appeared to respond to a repeated stimulus more frequently with previously rewarded actions (inferred response to place) than with internalized images (inferred retention of stimulus in context on permanence of objects) in solving delayed recall problems.

In a subsequent study Brockman (1976) demonstrated that 18- and 24-month children tended to respond correctly on no-delay conditions less frequently than 30- and 36-month children. Also, more correct responses were given on no-delay than on 5-second delay conditions irrespective of age differences. Visual rehearsal during the 5-second delay increased correct responses. She interpreted these results to mean that the younger children learned and retained a motor response to a place while the older children learned and retained information about a stimulus in context. Brockman stated it was as if the younger children had learned a motor response through a pattern of kinesthetic cues which guided them back to the place where they had previously been successful, and as if the older children, judged from their increased correct responding, had assimilated information about the stimulus in context which suggested representational schema functioning. Brockman further points out that the additional opportunity to learn place resulted in a decrease in

correct responding on the critical trial for the younger children but an increase in correct responding for the older children. This further supports the hypothesis that younger children were assimilating task information to an action scheme, and that in keeping with Piaget's equilibration model that older children were functioning at a representational level in retaining information about the stimulus in context.

This study attempts to determine the measurability of sensorimotor development in severely reatrded, institutionalized adults by using the Piagetian concept of object permanence in a delayed recall paradigm. In addition, if object permanence is measureable, the persistence of the memory trace after an interpolated delay will be investigated. Other standardized measures of early mental/psychomotor and social development will also be given with the intent of further describing the developmental level of severely retarded persons.

METHOD

Subjects. The subjects were sixty severely retarded adults (30 males and 30 females) residing in a state institution. The Ss ranged from 9.5 months to 30 months in mental age; from 20 years, 11 months to 62 years, 8 months in chronological age; and from 15.6 months to 61.2 months in social age equivalency. The mental and psychomotor ages were derived from the Baley Scales of Infant Development. The social age equivalency data were obtained from the Vineland Social Maturity Scale.

Apparatus. The delayed recall apparatus was recessed into the top of a child's table, allowing access by the subjects to three independently sliding screens

(17.7 x 27.5 cm): (1) The top screen was clear to allow the subject to see but not to touch. (2) The next screen was opaque to hide the stimulus during the delay interval. (3) The bottom screen contained three doors which allowed the subjects to respond to one of three positions (A, B, or C) by opening one of its horizontally sliding doors. Under the screen containing the three doors was a black glass presentation tray.

A white china top cup (2.6 cm high and 2.6 cm in diameter) was mounted on a 1.5 mm metal disk of the same diameter as the cup. A magnet on a wand was used beneath the presentation tray to permit the experimenter to move the cup into position while the adult watched through the clear glass screen.

Procedures. Testing was conducted in the activity area associated with each wing of the State School where residents participating in this experiment were living. One trained timer-recorder and one trained experimenter were present during every session. In most instances, a school programmer from the wing being test was present during the testing. The programmer remained in a chair placed several feet to the rear and side of the subject.

During training the subject was introduced to the task of finding a toy cup which had been hidden beneath either door A, B, or C. When the subject correctly found the cup on three successive trials, it was evident that the subject understood the task of finding the cup under the door, and testing proper proceeded. Though S was permitted to respond to all three doors, the cup was hidden only in the A and C positions (Clark and Brockman, 1966), (Brockman, 1977). A cord and pulley system were used to draw the opaque and door screens into place simultaneously. In the no-delay conditions (two and three opportunities to learn place) the clear screen and the opaque screen were simultaneously opened, exposing the door screen for the subject to respond.

In the delay condition the clear and opaque screens remained closed for the designated time interval.

The sequence of trials were divided into six blocks. Blocks 1 and 2 contained four trials each with no delay between the hiding of the top cup and the opportunity for the subject to respond. Blocks 3, 4, 5, and 6 contained three trials each with five-second delays in Block 3, ten-second delays in Block 4, twenty-second delays in Block 5, and thirty-second delays in Block 6. Two forms of the test were used so that order of presentation was counterbalanced among the subjects.

After the subject understood the task, trial one was begun. Testing was continued until the subject failed all the trials in any single block or completed the six blocks. Subjects were retested two days after their first testing with the alternate form of the test.

The task was administered with very few verbal instructions. Gestures, facial expressions, and supportive remarks were limited but given if reinforcement of effort was needed. A candy (M & M), raisin, or cereal was placed in the cup for the subject as a reward for a correct response.

Response Measures. The order in which a subject opened the three doors and the hand (right or left) used to open each door were recorded by two trained observers during the testing session. If two doors were opened simultaneously, the trial was recorded equally for both doors.

Critical Trial Sequence. Imposed on the six blocks of trials was a critical trial sequence. Each critical trial sequence consisted of four trials, the fourth trial requiring a shift in the position of the toy cup. Thus, the fourth door opening in any sequence became the critical trial. Two levels of learning and five conditions of delay were contrasted within this trial format.

Learning was operationally described on the basis of the number of opportunities to learn place. Thus, two successive trials in which the cup was hidden in the same position immediately preceding the critical trial (i.e., ACCA) was considered two opportunities to learn place and three same-position trials (i.e., AAAC), three opportunities to learn place. On the delay condition the contrast was among the no delay on three opportunities to learn place (i.e., AAAC) and the 5-, 10-, 20-, and 30-second delays interpolated before the subject was permitted to respond on each of the AAAC trials. Counterbalancing correct-trial positions resulted in half the subjects from each sex subgroup being presented with correct trial positions of CAAC for two opportunities and CCCA for three opportunities to learn place with no delay, and counterbalanced pattern for 5, 10, 20, and 30 seconds.

There were twenty trials spread across six blocks: four trials each in the no-delay condition of blocks 1 and 2 and three trials each in the delay conditions of Blocks 3 through 6. Since each critical trial sequence required four trials, the last trial in Block 2 and the first trial in Blocks 4, 5, and 6 served not only as a trial in these blocks but also as the fourth trial for Blocks 3, 4, 5, and 6 respectively.

Each trial was scored on the basis of the number of doors opened to find the cup. A correct door opening on the first response was awarded 2 points. A correct door on the second response received 1 point. All other responses were scored 0 points. With each sequence of trials per condition a subject could obtain a maximum score of 4 points for a condition. Separate factorial analyses for opportunities to learn place and delay conditions were based on the scores for trials 3, 7, 10, 13, 16, and 19 and the critical trial scores for 4, 8, 11, 14, 17, and 20.

RESULTS

Preliminary analyses indicated no differences in performance associated with counterbalanced correct-trial positions or permuted order of critical trial sequences. Therefore, analyses of the data are collapsed across these variables (days and counterbalancing sequences).

Comparison of two and three opportunities to learn place with no interpolated delay, 5-, 10-, 20-, and 30-second delay demonstrates that the three main effects are significant (sex, $F = 4.16$, p .05; blocks, $F = 32.19$, p .01; trials, $F = 41.64$, p .01). Further, no interactions are significant, nor even approach significance.

The sex effect is due to the males scoring higher than the females. From Table I, it can be seen that the males' means exceed the females' means for every treatment combination. The sex difference is most evident in Block 2, and the difference in this block is largest on the critical trial.

Put Table I here

Table II shows the trial effect means. In every case, the trial 3 means exceed the corresponding critical trial means. Except for the first block, the differences are fairly substantial. The block effect can also be seen as a measure of trend. There is a monotonic decrease over time. Only the first drop (from block 1 to block 2) is not substantial.

Put Table II here

Comparison of two and three opportunities to learn place with no delay shows no significant differences, though the means for three trials to learn place were higher.

Comparisons of three opportunities to learn place with no interpolated delay and 5-, 10-, 20-, and 30-second delay shows a significant main effect for sex, age, and blocks with no significant interactions. As expected, scores decrease as time increases and critical trial scores are lower than scores for the trials preceding the critical trials.

The correlations among the Piagetian object permanence tasks and the Baley psychomotor performance scales are quite modest, in no case yielding zero-order correlations in excess of .30. The Baley Developmental Scale shows somewhat stronger relationships to the object permanence tasks; the correlations tend to become larger with the longer delayed responses. The Vineland scores tend to correlate in an intermediate range between the two Baley scales.[1]

DISCUSSION

The results obtained from the delayed recall scores suggest that severely retarded, institutionalized adults learn most efficiently when trained with no interpolated delays. However, the group appeared able to assimilate information about the stimulus in context; despite the design to train them in motor learning, the significant number who responded correctly on the critical trials suggested representational schema functioning. This pattern of learning matches more closely the recorded performances of the 30-36 month old children in the Brockman study (1977) who appeared to learn and retain information in context as contrasted with the 18-24 month old children who

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[1]Correlation Table available upon request from the authors.

appeared to learn and retain a motor response to a place.

However, all the groups of young children in Brockman's study became increasingly unsuccessful in making correct responses when interpolated delays were introduced into the tasks, and in fact were not taken past the 5-second delay period. In contrast, the majority of the severely retarded adults was able to perservere with the tasks successfully through the 30-second delay period. Correct responses among the retarded decreased as a function of increased delays, but the group in general could be characterized as capable of representational schema and of retaining memory of an image in relation to external cues over brief time periods. The level of development of representational schemata functioning appeared similar to the 36 month old children except that the retarded were able to (1) persist longer with the task and to (2) hold the mental image for a longer period of time. The fact that these two scales did not significantly correlate with each other or with the Piagetian object permanence task is not necessarily negative. It could simply mean that the three tests measure relatively unrelated skills.

TABLE I

MEAN SCORES ON THIRD TRIALS AND CRITICAL TRIALS FOR TWO AND THREE OPPORTUNITIES TO LEARN PLACE AND FOR 0, 5, 10, 20 AND 30 SECOND DELAYS OF SEVERELY RETARDED ADULTS. (N = 60)

Opportunities to learn place:	TWO	THREE	THREE	THREE	THREE	THREE
Interpolated Delay :	NONE	NONE	5 SEC.	10 SEC.	20 SEC.	30 SEC.
BLOCK:	ONE	TWO	THREE	FOUR	FIVE	SIX
Trial 3 mean	M=3.40	M=3.60	M=3.27	M=2.83	M=2.73	M=2.50
	M=3.00	M=2.97	M=2.90	M=2.63	M=2.43	M=2.03
Critical Trial mean	M=3.33	M=3.50	M=3.03	M=2.63	M=2.07	M=1.90
	F=2.93	F=2.53	F=2.20	F=2.23	F=1.73	F=1.77

TABLE II

MEAN SCORES FOR TRIAL X BLOCKS

	BLOCK						
	1	2	3	4	5	6	
Trial 3 Means	3.20	3.28	3.08	2.73	2.58	2.26	2.86
Critical Trial Means	3.13	3.02	2.62	2.43	1.90	1.84	2.49
Combined Means	3.16	3.15	2.85	2.58	2.24	2.05	

Males 2.90
Females 2.45

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